

FORM PTO-1390 REV. 5-93		US DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEYS DOCKET NUMBER P98,2706
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. (if known, see 37 CFR 1.5) 09/194286
INTERNATIONAL APPLICATION NO. PCT/DE97/00954	INTERNATIONAL FILING DATE 12 May 1997	PRIORITY DATE CLAIMED 21 May 1996	
TITLE OF INVENTION A METHOD FOR OPTIMIZING THE UTILIZATION OF CONNECTING SECTIONS IN SYSTEMS IN WHICH INFORMATION IS TRANSMITTED IN DATA PACKETS			
APPLICANT(S) FOR DO/EO/US Uwe Briem			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay. 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of International Application as filed (35 U.S.C. 371(c)(2)) a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US) 6. <input checked="" type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)) 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. §371(c)(3)) a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). b. <input type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input checked="" type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). EXECUTED 10. <input checked="" type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). Items 11. to 16. below concern other document(s) or information included: 11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98; (PTO 1449, Prior Art, Search Report) 12. <input checked="" type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included SEE ATTACHED ENVELOPE 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 14. <input type="checkbox"/> A substitute specification. 15. <input type="checkbox"/> A change of power of attorney and/or address letter. 16. <input checked="" type="checkbox"/> Other items or information: a. <input checked="" type="checkbox"/> Submission of Drawings Figs. 1-3 on 2 sheets b. <input checked="" type="checkbox"/> EXPRESS MAIL #EL071033863US dated 11-23-98			

U.S. APPLICATION NO. (if known, see 37 C.F.R. 1.5)

INTERNATIONAL APPLICATION NO.

ATTORNEY'S DOCKET NUMBER

PCT/DE97/00954

P98,2706

17. ☒ The following fees are submitted:**BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5):**

Search Report has been prepared by the EPO or JPO \$840.00

International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) .. \$720.00

No international preliminary examination fee paid to USPTO (37 C.F.R. 1.482) but
international search fee paid to USPTO (37 C.F.R. 1.445(a)(2)) \$790.00Neither international preliminary examination fee (37 C.F.R. 1.482) nor international
search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO \$1070.00International preliminary examination fee paid to USPTO (37 C.F.R. 1.482) and all
claims satisfied provisions of PCT Article 33(2)-(4) \$ 98.00**ENTER APPROPRIATE BASIC FEE AMOUNT =**

CALCULATIONS

PTO USE ONLY

\$ 840.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months
from the earliest claimed priority date (37 C.F.R. 1.492(e)).

\$

Claims

Number Filed

Number
Extra

Rate

Total Claims

10 - 20 =

0

X \$ 18.00

\$

Independent Claims

1 - 3 =

0

X \$ 78.00

\$

Multiple Dependent Claims

\$260.00 +

\$

TOTAL OF ABOVE CALCULATIONS =

\$ 840.00

Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also
be filed. (Note 37 C.F.R. 1.9, 1.27, 1.28)

\$

SUBTOTAL =

\$ 840.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months
from the earliest claimed priority date (37 CFR 1.492(f)).

\$

TOTAL NATIONAL FEE =

\$ 840.00

Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be
accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). \$40.00 per property

+

TOTAL FEES ENCLOSED =

\$ 840.00

Amount to be
refunded

\$

charged

\$

a. ☒ A check in the amount of \$ 840.00 to cover the above fees is enclosed.b. ☐ Please charge my Deposit Account No. _____ in the amount of \$ _____ to cover the above fees.
A duplicate copy of this sheet is enclosed.c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any
overpayment to Deposit Account No. 08-2290. A duplicate copy of this sheet is enclosed.NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be
filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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SIGNATURE

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NAME

39,056

Registration Number

#2

BOX PCT

IN THE UNITED STATES ELECTED OFFICE
OF THE UNITED STATES PATENT AND TRADEMARK OFFICE
UNDER THE PATENT COOPERATION TREATY-CHAPTER II

PRELIMINARY AMENDMENT

APPLICANT: Uwe Briem

DOCKET NO: P98,2706

SERIAL NO:

GROUP ART UNIT:

EXAMINER:

INTERNATIONAL APPLICATION NO: PCT/DE97/00954

INTERNATIONAL FILING DATE: 12 May 1997

INVENTION: **A METHOD FOR OPTIMIZING THE UTILIZATION OF
CONNECTING SECTIONS IN SYSTEMS IN WHICH
INFORMATION IS TRANSMITTED IN DATA PACKETS**

Assistant Commissioner for Patents,
Washington, D.C. 20231

Sir:

Please amend the above-identified International Application before
entry into the National stage before the U.S. Patent and Trademark Office
under 35 U.S.C. §371 as follows:

In The Specification:

On page 1, cancel lines 1-6 and substitute therefor:

--S P E C I F I C A T I O N

TITLE

**A METHOD FOR OPTIMIZING THE UTILIZATION OF CONNECTING
SECTIONS IN SYSTEMS IN WHICH INFORMATION IS TRANSMITTED
IN DATA PACKETS**

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a method for optimizing the
utilization of connecting sections in systems in which information is

transmitted in data packets, wherein the weighted fair queueing scheduling method is used for the transmission of data packets and ensures a lower limit on the transmission rate thereof, and wherein an additional scheduling method is used in conjunction with the first scheduling method so as to achieve an upper limit on the transmission rate as well.

Description of the Prior Art--

On page 1, line 11, insert --is used-- after "part".

On page 2, line 1, cancel "this" and substitute therefor --Fig. 3--.

On page 2, line 28, insert a --,-- after "is".

On page 2, line 28, insert a --,-- after "case".

On page 2, line 31, cancel "for this purpose".

On page 2, line 33, cancel "per se" and substitute therefor a --,--.

On page 3, line 3, insert a --,-- after "which".

On page 3, line 4, insert a --,-- after "which".

On page 3, line 12, insert a --,-- after "this".

On page 3, line 26, cancel the "-" and substitute therefor a --;--.

On page 3, line 27, insert a --,-- after "example".

On page 3, before line 28, insert the following centered heading:

--SUMMARY OF THE INVENTION--

On page 3, line 28, insert --present-- before "invention".

On page 3, line 28, cancel "based on the object of" and substitute therefor --therefore directed toward--.

On page 3, line 31, cancel "here".

On page 3, line 31, insert the following sentence after the period:

--Such object is achieved in a method which includes the use of an additional scheduling method prior to the weighted fair queueing scheduling method so as to achieve an upper limit on the transmission rate of data packets.--

On page 4, cancel lines 1-4.

On page 4, line 5, insert --present-- before "invention".

On page 4, line 10, insert a --,-- after "results".

On page 4, line 10, insert a --,-- after "particular".

On page 4, lines 11-12, cancel "In particular, this" and substitute therefor --This--.

On page 4, line 12, insert --, however,-- after "not".

On page 4, cancel lines 14-15 and substitute therefor:

--Accordingly, in an embodiment of the present invention, a first scheduling method is provided by means of which connection parameters, which are representative of lower transmission rates of data packets, are guaranteed during a transmission process. Also provided is a queue identifier which is stored in a data header. Furthermore, a second scheduling method is provided which precedes the first scheduling method depending on the queue identifier, wherein the connection parameters which are representative of upper transmission rates of the data packets are also limited during the transmission process.--

On page 4, line 16, cancel "Claim 2 provides that" and substitute therefor --In an embodiment,--.

On page 4, line 17, cancel the ",".

On page 4, line 23, cancel "Claim 3 provides that" and substitute therefor --In an embodiment,--.

On page 4, line 29, cancel "Claim 4 provides for" and substitute therefor --In an embodiment,--.

On page 4, line 29, insert --is provided-- after "device".

On page 4, line 30, cancel "contains" and substitute therefor --includes--.

On page 5, line 1, cancel "Claim 5 provides that" and substitute therefor --In an embodiment--.

On page 5, line 13, cancel "Claim 6 provides that" and substitute therefor --In an embodiment,--.

On page 5, line 15, cancel "Claim 7 provides that" and substitute therefor --In an embodiment,--.

On page 5, line 16, insert --present-- before "invention".

On page 5, line 16, insert --thus-- after "invention".

On page 5, line 16, cancel "thus".

On page 4, line 10, insert a --,-- after "results".

On page 4, line 10, insert a --,-- after "particular".

On page 4, lines 11-12, cancel "In particular, this" and substitute therefor --This--.

5 On page 4, line 12, insert --, however,-- after "not".

On page 4, cancel lines 14-15 and substitute therefor:

--Accordingly, in an embodiment of the present invention, a first scheduling method is provided by means of which connection parameters, which are representative of lower transmission rates of data packets, are guaranteed during a transmission process. Also provided is a queue identifier which is stored in a data header. Furthermore, a second scheduling method is provided which precedes the first scheduling method depending on the queue identifier, wherein the connection parameters which are representative of upper transmission rates of the data packets are also limited during the transmission process.--

10 On page 4, line 16, cancel "Claim 2 provides that" and substitute therefor --In an embodiment,--.

On page 4, line 17, cancel the " , " .

15 On page 4, line 23, cancel "Claim 3 provides that" and substitute therefor --In an embodiment,--.

20 On page 4, line 29, cancel "Claim 4 provides for" and substitute therefor --In an embodiment,--.

On page 4, line 29, insert --is provided-- after "device".

25 On page 4, line 30, cancel "contains" and substitute therefor --includes--.

On page 5, line 1, cancel "Claim 5 provides that" and substitute therefor --In an embodiment--.

On page 5, line 13, cancel "Claim 6 provides that" and substitute therefor --In an embodiment,--.

On page 5, line 15, cancel "Claim 7 provides that" and substitute therefor --In an embodiment,--.

On page 5, line 16, insert --present-- before "invention".

On page 5, line 16, insert --thus-- after "invention".

On page 5, line 16, cancel "thus".

On page 5, cancel line 18 and substitute therefor:

--Additional features and advantages of the present invention are described in, and will be apparent from, the Detailed Description of the Preferred Embodiments and the Drawings.

DESCRIPTION OF THE DRAWINGS--

On page 5, line 19, insert --a schematic representation of-- after "shows".

On page 5, line 19, insert --present-- before "invention".

On page 5, line 19, cancel the "," and substitute therefor a --.--.

On page 5, line 20, insert --a schematic representation of-- after "shows".

On page 5, line 21, cancel the "," and substitute therefor a --.--.

On page 5, line 22, insert --a schematic representation of-- after "shows".

On page 5, before line 24, insert the following centered heading:

--DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS--

On page 5, line 24, insert --a schematic representation of the-- after "shows".

On page 5, line 25, insert --present-- before "invention".

On page 6, line 4, cancel "has been" and substitute therefor --is--.

On page 6, line 13, insert --and-- before "designed".

On page 6, line 13, cancel the "," after "queue".

On page 7, line 3, insert a --.-- after "example".

On page 7, line 6, cancel the ",".

On page 7, line 12, insert --however,-- before "it".

On page 7, line 12, cancel the "," after "produces".

On page 7, line 14, cancel the "," and substitute therefor --which--.

On page 7, line 14, cancel "corresponding" and substitute therefor
--corresponds--.

On page 7, line 23, insert --thus-- before "may".

On page 7, line 23, cancel "thus".

On page 7, line 29, insert --present-- before "invention".

On page 8, line 14, cancel "This method means that" and substitute
therefor --Pursuant to this method,--.

On page 8, line 19, insert a --,-- after "which".

On page 8, line 20, insert a --,-- after "which".

On page 8, line 24, insert --present-- before "invention".

On page 8, line 25, insert --present-- before "invention".

On page 8, line 26, insert --likewise-- before "can".

On page 8, line 26, cancel "likewise".

On page 8, line 27, insert a --,-- after "case".

On page 8, after line 29, insert the following paragraph:

--Although the present invention has been described with reference
to specific embodiments, those of skill in the art will recognize that changes
may be made thereto without departing from the spirit and scope of the
invention as set forth in the hereafter appended claims.--

On page 11 (last page), cancel lines 1-4 and substitute the following
centered heading therefor:

--ABSTRACT OF THE DISCLOSURE--

On page 11, line 5, cancel "The" and substitute therefor --Wherein
the--.

On page 11, line 7, cancel ". This" and substitute therefor --, such--.

On page 11, line 10, cancel "may be" and substitute therefor --is--.

On page 11, lines 10-11, cancel "prior to this, in the method according to the invention" and substitute therefor --wherein the further scheduling method precedes the scheduling method--.

On page 11, cancel line 12.

In the Claims:

On page 9, cancel line 1, and substitute therefor:

--I Claim As My Invention--.

Please cancel claims 1-7, without prejudice, and substitute the following claims therefor:

8. A method for optimizing the utilization of connecting sections in systems in which information is transmitted in data packets, the method comprising the steps of:

providing a first scheduling method by means of which connection parameters, which are representative of lower transmission rates of the data packets, are guaranteed during a transmission process;

providing a queue identifier which is stored in a packet header; and

providing a second scheduling method which may precede the first scheduling method depending on the queue identifier, wherein the connection parameters which are representative of upper transmission rates of the data packets are limited during the transmission process.

9. A method as claimed in claim 8, wherein the first scheduling method is a weighted fair queueing scheduling algorithm.

10. A method as claimed in claim 8, further comprising the step of:

providing an input device which contains a table which includes the current filling levels of buffer stores.

11. A method as claimed in claim 9, further comprising the step of:

providing an input device which contains a table which includes the current filling levels of buffer stores.

12. A method as claimed in claim 10, further comprising the step of:

providing an output device for taking the data packets from at least one of the buffer stores, depending on control data which are obtained from the first scheduling method, and acknowledging such process to the input device.

13. A method as claimed in claim 11, further comprising the step of:

providing an output device for taking the data packets from at least one of the buffer stores, depending on control data which are obtained from the first scheduling method, and acknowledging such process to the input device.

14. A method as claimed in claim 8, wherein the queue identifier is entered while the connection is being set up.

15. A method as claimed in claim 9, wherein the queue identifier is entered while the connection is being set up.

16. A method as claimed in claim 8, wherein the data packets are ATM cells.

17. A method as claimed in claim 9, wherein the data packets are ATM cells.

REMARKS

The present amendment makes editorial changes and corrects typographical errors in the specification in order to conform the specification to the requirements of the United States Patent practice. No new matter is added thereby. Original claim 1-7 have been canceled in favor of new claims 8-17. However, claims 8-17 have been presented solely because the revisions by bracketing and underlining which would have been necessary in claim 1-7 in order to conform those claims to the requirements of United States Patent practice would have been too extensive, and thus would have been too burdensome. The cancellation of the original claim does not constitute an intent on the part of the Applicant to surrender any of the subject matter of such claim.

Early consideration on the merits is respectfully requested.

Respectfully submitted,



(Reg.No. 39,056)

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Description

Method for optimization of the utilization of
connecting sections in systems in which information
is transmitted in data packets.

5 The invention relates to a method as claimed in
the precharacterizing clause of patent claim 1.

 In modern packet switching systems, information
is transmitted in data packets. One example of this is
ATM cells. These have a header part and an information
10 part. The header part is used to store connection infor-
mation, and the information part to store the wanted data
to be transmitted. As a rule, the actual transmission
takes place via connecting sections between the trans-
mitter and receiver. In this case, there may be a
15 requirement to utilize the connecting sections in such a
manner that a plurality of transmitting devices transmit
the cell streams originating from these devices via the
same connecting section.

 In order to allow the transmission of the respec-
20 tive cell streams to be carried out in accordance with
the requirements of the individual cell streams, a so-
called WEIGHTED FAIR QUEUEING SCHEDULING method has
become generally accepted in the prior art. The corres-
ponding relationships are described, for example, in the
25 document "Virtual Spacing for Flexible Traffic Control",
J.W. Roberts, International Journal of Communication
Systems, Vol. 7, 307-318 (1994). In this case, the
individual cell streams are assigned different weighting
factors, which are used to control the actual trans-
30 mission process on the individual connecting sections.
Reference should be made to Figure 3 to assist under-
standing.

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By way of example, this shows cell streams 1 ...
n. The n cell streams are passed from a transmitting
device DEMUX in the direction of one or more receivers.
In practice, only one common connecting section is used
5 in this case. The n cell streams are furthermore assigned
weighting factors $r_1 \dots r_n$. To assist understanding, it
is assumed that it is intended to pass only two cell
streams, namely the cell streams 1, 2, via a connecting
section. The connecting section is furthermore intended
10 to have a maximum transmission capacity of 150 Mbit/s.
The two cell streams 1 and 2 are assigned weightings $r_1 =$
2 and $r_2 = 1$. This results in the cell stream 1 being
transmitted at a transmission rate of 100 Mbit/s, and the
cell stream 2 at only 50 Mbit/s, if cells for both cell
15 streams are present for transmission. If only one of the
two cell streams has cells to transmit, this cell stream
is assigned the total transmission capacity of
150 Mbit/s.

Figure 2 shows how the theoretical considerations
20 addressed above are implemented in practice in the prior
art. This shows how data packets, or ATM cells, are dealt
with using the weighted fair queueing scheduling
algorithm. In this case, incoming cells are supplied to
the input device EE, are passed on to the demultiplexing
25 device DEMUX and are stored there with the aid of a
demultiplexing function, which is implemented here, and
with the assistance of an identifier QID in a logic
queue. The identifier QID is in this case contained in
the cell header of each cell.

30 At the same time, control data which are deter-
mined in the input device EE are for this purpose
supplied to a scheduler device S. A scheduling algorithm
which is known per se is executed in this device.

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This may be, for example, the weighted fair queueing
scheduling algorithm or any other algorithm. This
algorithm determines, for example, the sequence in which
or the time at which it is intended to read the cells
5 which are stored in the buffer stores $P_1 \dots P_n$. The result
of the assessment of the control data by this algorithm
is supplied to the output device AE. The cells stored in
the buffer stores $P_1 \dots P_n$ are now read, on the basis of
the result of the assessment, by the algorithm which is
10 being executed in the scheduling device S. Furthermore,
an acknowledgement signal is fed back to the input device
EE. After this and when a new cell with an identifier QID
arrives in the input device EE and when an acknowledge-
ment 'selected QID' is present, the input device EE uses
15 the buffer filling level for $QID = i$ as well as the
scheduling method to decide whether the message "SCHEDULE
QID" is generated. This message indicates to the
scheduler device S that it should carry out initial
planning for the next transmission time for this identi-
20 fier QID, in some way.

A problematic feature of such a procedure is
that, although the weighted fair queueing scheduling
algorithm guarantees minimum cell rates, a maximum cell
rate limiting cannot be carried out here. However, this
25 is a major factor since, in practice, both minimum and
maximum cell rates often have to be complied with - for
example in the case of ABR (available bit rate) traffic.

The invention is based on the object of indicat-
ing a way in which the weighted fair queueing scheduling
30 algorithm can be modified in such a way that optimized
transmission is ensured here as well.

The object is achieved on the basis of the features specified in the precharacterizing clause of patent claim 1, by means of the features in the characterizing part.

5 An advantageous feature of the invention is that a two-stage scheduling method may be carried out depending on an identifier which is contained in the packet header. In this case, the result of the first stage is used as an input signal for the second stage. This
10 results in particular in the capability to control both a lower limit and an upper limit of the cell rate. In particular, this method is not limited to the use of a specific algorithm.

15 Further refinements of the invention are provided in the dependent claims.

20 Claim 2 provides that the connection parameters are limited during the transmission process, by means of the first stage of the two-stage scheduling method. This is intended, in particular, to control limiting of the cell rate. This results in the cells not being transmitted at higher cell rates during the transmission process.

25 Claim 3 provides that the second stage of the two-stage scheduling method is the weighted fair queueing scheduling algorithm. This is linked to the advantage that a proven method can be used. A further advantage of this is that this algorithm guarantees lower limiting of the cell rate.

30 Claim 4 provides for an input device to contain a table which contains the current filling levels of the buffer stores. This is linked to the advantage that a current map of these filling levels is stored here at all times.

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Claim 5 provides that, depending on the control data obtained from the scheduler device, the output device takes cells from at least one of the buffer stores and acknowledges this process to the input device. As a result of the feedback, the reading process has a direct influence on the first stage of the two-stage method. The two stages of the two-stage scheduling method thus do not operate independently of one another. The way in which the first stage operates is influenced by the way in which the second stage operates. The identifier or the packet length may be used, for example, as feedback parameters.

Claim 6 provides that the identifier is entered while the connection is being set up.

Claim 7 provides that the data packets are ATM cells. The invention can thus be applied in particular to ATM networks.

In the figures:

Figure 1 shows the method according to the invention,

Figure 2 shows the practical application of the prior art,

Figure 3 shows theoretical considerations relating to the prior art.

Figure 1 shows the method according to the invention. In this case, it is assumed that the information is transmitted in ATM cells, using an asynchronous transfer method (ATM).

The cells are supplied to the input device EE in a cell stream. The routing information is stored in the header part of each cell. Furthermore, an identifier QID has been stored here while the connection is being set up. This identifier is a cell stream identifier which is entered in the cell header on a connection-specific basis or for a group of connections. As a rule, the identifier QID is assigned simple numerical values. In the present exemplary embodiment, the identifier QID is intended to have the values 1...N. Originating from the input device EE, the cells themselves are supplied to the demultiplexing device DEMUX where they are written into buffer stores P1...Pn, designed as a logic queue, with the aid of a demultiplexing function, which is implemented here, and with the assistance of the identifier QID.

The input device EE furthermore contains a table T as to which of the connections require the connection parameters to be limited during the transmission process. In the present exemplary embodiment, it is assumed that limiting of the cell rate is controlled in the sense of limiting the connection parameters. In order to verify the connection, the identifier QID is taken from each of the incoming cells and is compared with the entries in the table T.

If it is not intended to limit the cell rate for a connection, corresponding control data are supplied via the connecting section B to the scheduler device S_2 , bypassing the scheduler device S_1 . There, the control data are used in a scheduling algorithm which is known per se. In the present exemplary embodiment, this is intended to be weighted fair queueing scheduling method, which has already been described in the introduction. Such an algorithm results in a lower cell rate being guaranteed, in the sense of guaranteeing the connection parameters of the cells during the transmission process.

According to the present exemplary embodiment, the cell rate for one of the connections is limited, for example for the connection with the number 8 (QID=8). In this case, the control data are supplied via the connecting section A to the scheduler device S_1 . Here, an algorithm starts to be executed, which controls an upper limit on the cell rate. This is done by a function implemented here using the identifier QID for initial planning of the control data supplied from the input device EE, such that the individual cells do not exceed a predetermined rate. At the time at which the scheduler device S_1 would read a cell, it produces, however, a control signal itself for initial planning of the read time, corresponding to the general scheduling algorithm being executed in the scheduler device S_2 . No initial planning of the next event takes place in the scheduler device S_1 for the same identifier QID. Thus, stimulated by the scheduler device S_1 , the scheduler device S_2 plans the sequence for the indicated identifier QID, corresponding to the scheduling algorithm being executed here. The cells initially planned by the scheduler device S_1 may thus experience an additional delay. The peak bit rate set in the scheduler device S_1 may thus be different from that used to read the cells.

By way of example, the weighted fair queueing scheduling algorithm is intended to be used in the scheduler device S_2 in the present exemplary embodiment, although other algorithms can also be used. The method according to the invention is not limited to the use of a specific algorithm.

The result of the evaluation of the algorithm being executed in the scheduler device S_2 is passed to the output device AE.

Whenever it is intended to read the next cell from a buffer store $P_1 \dots P_n$ with a specific identifier QID, this is indicated to the output device AE. This reads the first cell with the indicated identifier QID from the
5 buffer store $P_1 \dots P_n$ in question, and reports this together with the corresponding identifier QID to the input device EE. The latter then checks whether a further cell with this QID is stored in the buffer store. If this is the case, a corresponding signal (SCHEDULE QID) is
10 sent to the scheduler device S_1 . If this is not the case, no further action takes place in the sense of initial planning (reading) in the scheduler device S_1 for this identifier QID.

This method means that an event for an identifier QID can be initially planned only in the scheduler device
15 S_1 or S_2 , but not at the same time in both devices. Furthermore, the two function blocks S_1 and S_2 are not linked to a specific implementation. This two-stage algorithm is thus used to determine the sequence in which
20 and the time at which it is intended to read the cells which are stored in the buffer stores $P_1 \dots P_n$.

Finally, it should also be mentioned that the above exemplary embodiment has been described using the example of ATM cells. However, the invention is not just
25 limited to this. The method according to the invention can likewise be used for the transmission of information in data packets as such. However, in this case it is necessary to ensure that the packet length is added to the control data.

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Patent Claims

1. A method for optimization of the utilization of connecting sections in systems in which information is transmitted in data packets, having
- 5 a scheduling method (S_2) by means of which connection parameters, which are representative of lower transmission rates of the data packets, are guaranteed during the transmission process, and having
- 10 a queue identifier (QID) which is stored in the packet header, characterized
- in that a further scheduling method (S_1) may precede the scheduling method (S_2) depending on the queue identifier (QID), by means of which further scheduling method (S_1)
- 15 the connection parameters which are representative of upper transmission rates of the data packets are limited during the transmission process.
2. The method as claimed in claim 1, characterized
- 20 in that the scheduling method (S_2) is a weighted fair queueing scheduling algorithm.
3. The method as claimed in claim 1 or 2, characterized
- 25 in that an input device (EE) contains a table (T) which contains the current filling levels of buffer stores ($P_1 \dots P_n$).

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4. The method as claimed in one of the preceding claims,

characterized

in that, depending on the control data which are obtained from the scheduling method (S_2), an output device (AE) takes data packets from at least one of the buffer stores ($P_1...P_n$) and acknowledges this process to the input device (EE).

5. The method as claimed in one of the preceding claims,

characterized

in that the queue identifier (QID) is entered while the connection is being set up.

6. The method as claimed in one of the preceding claims,

characterized

in that the data packets are ATM cells.

Abstract

Method for optimization of the utilization of connecting sections in systems in which information is transmitted in data packets.

The weighted fair queueing scheduling method has been developed in the prior art for the transmission of data packets. This method ensures only a lower limit on the transmission rate of the data packets. In order to be able to achieve an upper limit on the transmission rate as well, a further scheduling method may be used prior to this, in the method according to the invention.

Figure 1

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1 / 2

FIG 1

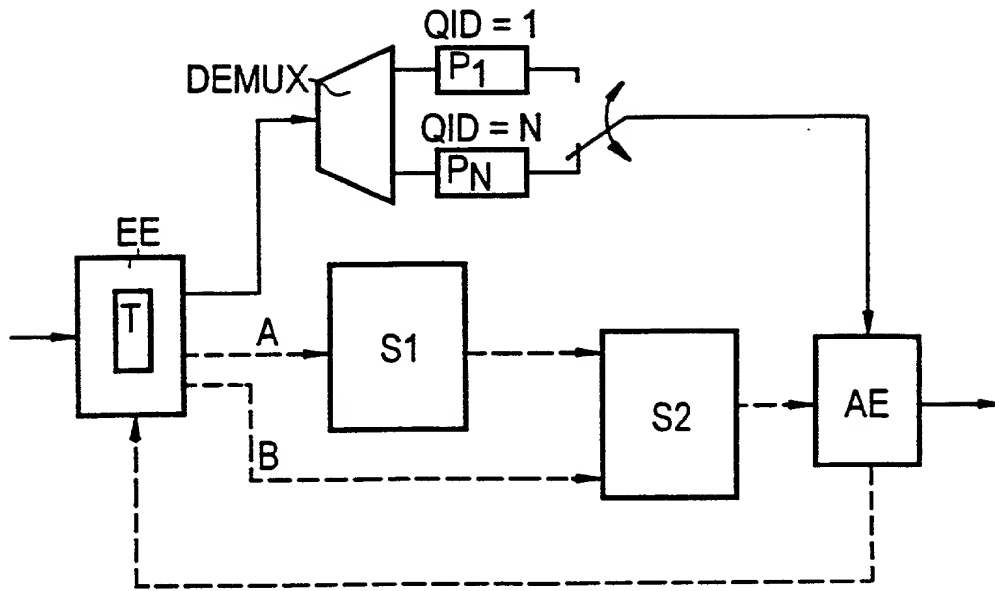


FIG 2

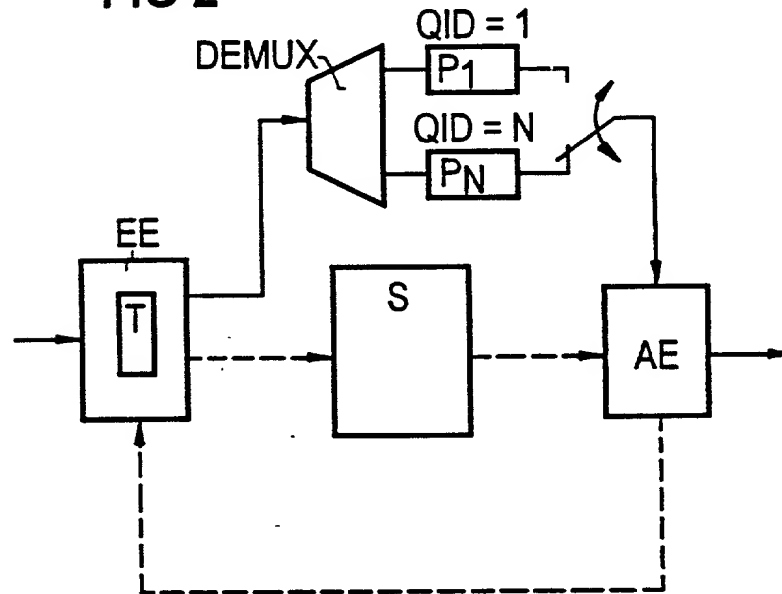
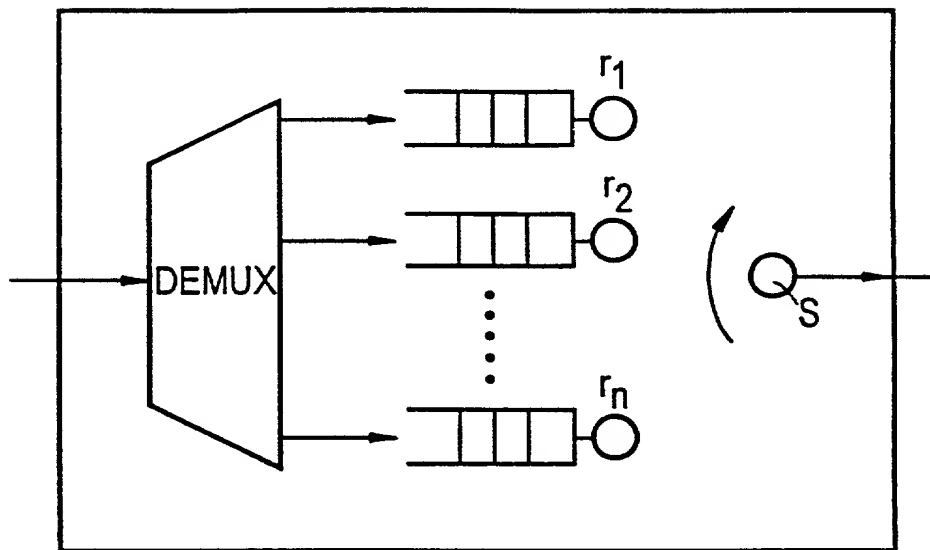


FIG 3



Declaration and Power of Attorney For Patent Application**Erklärung Für Patentanmeldungen Mit Vollmacht** *FB***German Language Declaration**

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

dass mein Wohnsitz, meine Postanschrift, und meine Staatsangehörigkeit den im Nachstehenden nach meinem Namen aufgeführten Angaben entsprechen,

dass ich, nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent beantragt wird für die Erfindung mit dem Titel:

Verfahren zur Optimierung der Auslastung von Verbindungsabschnitten in Systemen, in denen Informationen in Datenpaketen übertragen werden

deren Beschreibung

(zutreffendes ankreuzen)

☒ hier beigefügt ist.

☐ am _____ als

PCT internationale Anmeldung

PCT Anwendungsnummer _____

eingereicht wurde und am _____

abgeändert wurde (falls tatsächlich abgeändert).

Ich bestätige hiermit, dass ich den Inhalt der obigen Patentanmeldung einschliesslich der Ansprüche durchgesehen und verstanden habe, die eventuell durch einen Zusatzantrag wie oben erwähnt abgeändert wurde.

Ich erkenne meine Pflicht zur Offenbarung irgendwelcher Informationen, die für die Prüfung der vorliegenden Anmeldung in Einklang mit Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) von Wichtigkeit sind, an.

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Abschnitt 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 119 aller unten angegebenen Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde, und habe auch alle Auslandsanmeldungen für ein Patent oder eine Erfindersurkunde nachstehend gekennzeichnet, die ein Anmeldedatum haben, das vor dem Anmeldedatum der Anmeldung liegt, für die Priorität beansprucht wird.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

the specification of which

(check one)

☐ is attached hereto.

☐ was filed on _____ as

PCT international application

PCT Application No. _____

and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

06464686-14999

German Language Declaration

Prior foreign applications
Priorität beansprucht

Priority Claimed

196 20 428.3 Germany 21. Mai 1996
(Number) (Country) (Day Month Year Filed)
(Nummer) (Land) (Tag Monat Jahr eingereicht)

☒ ☐
Yes No
Ja Nein

(Number) (Country) (Day Month Year Filed)
(Nummer) (Land) (Tag Monat Jahr eingereicht)

☐ ☐
Yes No
Ja Nein

(Number) (Country) (Day Month Year Filed)
(Nummer) (Land) (Tag Monat Jahr eingereicht)

☐ ☐
Yes No
Ja Nein

Ich beanspruche hiermit gemäss Absatz 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 120, den Vorzug aller unten aufgeführten Anmeldungen und falls der Gegenstand aus jedem Anspruch dieser Anmeldung nicht in einer früheren amerikanischen Patentanmeldung laut dem ersten Paragraphen des Absatzes 35 der Zivilprozessordnung der Vereinigten Staaten, Paragraph 122 offenbart ist, erkenne ich gemäss Absatz 37, Bundesgesetzbuch, Paragraph 1.56(a) meine Pflicht zur Offenbarung von Informationen an, die zwischen dem Anmeldedatum der früheren Anmeldung und dem nationalen oder PCT internationalen Anmeldedatum dieser Anmeldung bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §122, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Application Serial No.)
(Anmeldeseriennummer)

(Filing Date)
(Anmeldedatum)

(Status)
(patentiert, anhängig,
aufgegeben)

(Status)
(patented, pending,
abandoned)

(Application Serial No.)
(Anmeldeseriennummer)

(Filing Date)
(Anmeldedatum)

(Status)
(patentiert, anhängig,
aufgeben)

(Status)
(patented, pending,
abandoned)

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00164286 112393

German Language Declaration

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POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

And I hereby appoint

Messrs. John D. Simpson (Registration No. 19,842), Lewis T. Steadman (17,074), William C. Stueber (16,453), P. Phillips Connor (19,259), Dennis A. Gross (24,410), Marvin Moody (16,549), Steven H. Noll (28,982), Brett A. Valiquet (27,841), Thomas I. Ross (29,275), Kevin W. Guynn (29,927), Edward A. Lehmann (22,312), James D. Hobart (24,149), Robert M. Barrett (30,142), James Van Santen (16,584), J. Arthur Gross (13,615), Richard J. Schwarz (13,472) and Melvin A. Robinson (31,879), David R. Metzger (32,919), John R. Garrett (27,888) all members of the firm of Hill, Steadman & Simpson, A Professional Corporation.

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312/876-0200

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Unterschrift des Erfinders 	Inventor's signature _____
Datum 14.4.1997	Date _____
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Staatsangehörigkeit Bundesrepublik Deutschland	Citizenship _____
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Voller Name des zweiten Miterfinders (falls zutreffend): _____	Full name of second joint inventor, if any: _____
Unterschrift des Erfinders _____	Second Inventor's signature _____
Datum _____	Date _____
Wohnsitz _____	Residence _____
Staatsangehörigkeit _____	Citizenship _____
Postanschrift _____ _____	Post Office Address _____ _____

(Bitte entsprechende Informationen und Unterschriften im Falle von dritten und weiteren Miterfindern angeben).

(Supply similar information and signature for third and subsequent joint inventors).

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